

Attachment D

Computation Sheet for Determining Runoff Coefficients

INSTRUCTIONS

- The runoff coefficient ("C" value) is used to estimate the impact on stormwater runoff due to development of a site. The C value is the amount of rainfall that becomes runoff. The less runoff that is absorbed into the ground, the higher the C value. This information may be provided by Caltrans.
- Refer to the Caltrans Highway Design Manual, Topic 819 – Estimating Design Discharge, for a more detailed explanation on calculating weighted runoff coefficients for areas containing varying amounts of different cover.
- Refer to Figure 819.2A, "Runoff Coefficients for Undeveloped Areas", and Table 819.2B, "Runoff Coefficients for Developed Areas" provided with this Attachment.

EXAMPLE

$$\text{Total Site Area} = 171,965 \text{ m}^2 \quad (\text{A})$$

Existing Site Conditions

$$\text{Impervious Area}^1 = 88,157 \text{ m}^2 \quad (\text{B})$$

$$\text{Impervious Area Runoff Coefficient}^{2,4} = 0.95 \quad (\text{C})$$

$$88157 \times 0.95 = 83,749 \text{ m}^2 \quad (\text{B} \times \text{C})$$

$$\text{Pervious Area}^3 = 83,808 \text{ m}^2 \quad (\text{D})$$

$$\text{Pervious Area Runoff Coefficient}^4 = 0.4 \quad (\text{E})$$

$$83808 \times 0.4 = 33,523 \text{ m}^2 \quad (\text{D} \times \text{E})$$

$$\text{Sum: } 83749 + 33523 = 117,272 \quad (\text{B} \times \text{C}) + (\text{D} \times \text{E})$$

$$\text{Divide: } 140738/171965 = 0.68 \quad \frac{(\text{B} \times \text{C}) + (\text{D} \times \text{E})}{(\text{A})}$$

$$\text{Existing Area Runoff Coefficient} = 0.68 \quad (\text{F})$$

Proposed Site Conditions

Impervious Area ¹	=	100,036 m ²	(G)
Impervious Area Runoff Coefficient ^{2, 4}	=	0.95	(H)
100036 x 0.95	=	95,034 m ²	(G x H)
Pervious Area ³	=	71,929 m ²	(I)
Pervious Area Runoff Coefficient ⁴	=	0.4	(J)
71929 x 0.4	=	28,771 m ²	(I x J)
Sum: 95034 + 28771	=	123,805	(G x H) + (I x J)
Divide: 123805/171965	=	0.72	$\frac{(G \times H) + (I \times J)}{(A)}$
Existing Area Runoff Coefficient	=	0.72	(F)

REQUIRED TEXT:

Total Site Area = _____ (A)

Existing Site Conditions

Impervious Site Area¹ = _____ (B)

Impervious Site Area Runoff Coefficient^{2, 4} = _____ (C)

Pervious Site Area³ = _____ (D)

Pervious Site Area Runoff Coefficient⁴ = _____ (E)

Existing Site Area Runoff Coefficient $\frac{(B \times C) + (D \times E)}{(A)}$ = _____ (F)

Proposed Site Conditions (after construction)

Impervious Site Area¹ = _____ (G)

Impervious Site Area Runoff Coefficient^{2, 4} = _____ (H)

Pervious Site Area³ = _____ (I)

Pervious Site Area Runoff Coefficient⁴ = _____ (J)

Proposed Site Area Runoff Coefficient $\frac{(G \times H) + (I \times J)}{(A)}$ = _____ (K)

1. Includes paved areas, areas covered by buildings, and other impervious surfaces.
2. Use 0.95 unless lower or higher runoff coefficient can be verified.
3. Includes areas of vegetation, most unpaved or uncovered soil surfaces, and other pervious areas.
4. See the table on the following page for typical C values.

Figure 819.2A

**Runoff Coefficients for Undeveloped Areas
Watershed Types**

	Extreme	High	Normal	Low
Relief	.28 -.35 Steep, rugged terrain with average slopes above 30%	.20 -.28 Hilly, with average slopes of 10 to 30%	.14 -.20 Rolling, with average slopes of 5 to 10%	.08 -.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	.12 -.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	.08 -.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	.06 -.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	.04 -.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	.12 -.16 No effective plant cover, bare or very sparse cover	.08 -.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	.06 -.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	.04 -.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover.
Surface Storage	.10 -.12 Negligible surface depression few and shallow; drainageways steep and small, no marshes	.08 -.10 Low; well defined system of small drainageways; no ponds or marshes	.06 -.08 Normal; considerable surface depression storage; lakes and pond marshes	.04 -.06 High; surface storage, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes.
Given	An undeveloped watershed consisting of; 1) rolling terrain with average slopes of 5%, 2) clay type soils, 3) good grassland area, and 4) normal surface depressions.			Solution: Relief 0.14 Soil Infiltration 0.08 Vegetal Cover 0.04 Surface Storage <u>0.06</u> C= 0.32
Find	The runoff coefficient, C, for the above watershed.			

Table 819.2B
Runoff Coefficients for
Developed Areas

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
Industrial:	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, cemeteries:	0.10 - 0.25
Playgrounds:	0.20 - 0.40
Railroad yard areas:	0.20 - 0.40
Unimproved areas:	0.10 - 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 - 0.10
Sandy soil, average, 2-7%	0.10 - 0.15
Sandy soil, steep, 7%	0.15 - 0.20
Heavy soil, flat, 2%	0.13 - 0.17
Heavy soil, average, 2-7%	0.18 - 0.25
Heavy soil, steep, 7%	0.25 - 0.35
Streets:	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and walks	0.75 - 0.85
Roofs:	0.75 - 0.95